

32. An immunoprotective modified pertussis toxin consisting of S1, S2, S3, S4 and S5 pertussis toxin subunits with the same arrangement and configuration presented by the natural pertussis toxin, wherein said modified pertussis toxin has no or reduced toxicity, wherein said modified pertussis toxin is modified by direct mutagenesis of the pertussis toxin S1 subunit gene, wherein the direct mutagenesis removes or replaces a single amino acid, wherein said single amino acid is GLU¹²⁹ in the S1 subunit.

33. The modified pertussis toxin of claim 32 wherein the GLU¹²⁹ is replaced by GLY¹²⁹.

65. A modified pertussis toxin consisting of S1, S2, S3, S4, and S5 pertussis toxin subunits with the same arrangement and configuration presented by the natural pertussis toxin, wherein the modified pertussis toxin is modified by direct mutagenesis of the pertussis toxin gene S1 subunit to have amino acid GLU¹²⁹ replaced by Gly, wherein the modified pertussis toxin has no or reduced toxicity, wherein said S1 subunit of said modified pertussis toxin is reactive with antipertussis toxin protective monoclonal antibodies.

66. A modified pertussis toxin consisting of S1, S2, S3, S4, and S5 pertussis toxin subunits with the same arrangement and configuration presented by the natural pertussis toxin, wherein the modified pertussis toxin is modified by direct mutagenesis of the pertussis toxin gene S1 subunit to have amino acids Phe⁵⁰ and Thr⁵³ replaced by Glu and Ile, respectively, wherein said S1 subunit of said modified pertussis toxin is reactive with antipertussis toxin protective monoclonal antibodies.

67. A modified pertussis toxin consisting of S1, S2, S3, S4, and S5 pertussis toxin subunits with
the same arrangement and configuration presented by the natural pertussis toxin, wherein the
modified pertussis toxin is modified by direct mutagenesis of the pertussis toxin gene S1 subunit
to have amino acids Tyr⁸ and Arg⁹ replaced by Asp and Gly, respectively, wherein said S1
subunit of said modified pertussis toxin is reactive with antipertussis toxin protective monoclonal
antibodies.